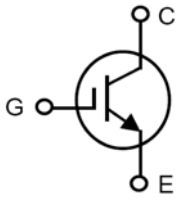
IXYS

Advance Technical Information

# High Voltage XPT™ IGBT

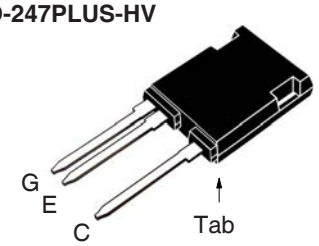
# IXYX40N250CHV

$V_{CES}$ = 2500V
$I_{C110}$ = 40A
$V_{CE(sat)}$ ≤ 4.0V
$t_{fi(typ)}$ = 134ns




| Symbol | Test Conditions | Maximum Ratings | |
|---|---|---|---|
| $V_{CES}$ | $T_J$ = 25°C to 175°C | 2500 | V |
| $V_{CGR}$ | $T_J$ = 25°C to 175°C, $R_{GE}$ = 1MΩ | 2500 | V |
| $V_{GES}$ | Continuous | ±20 | V |
| $V_{GEM}$ | Transient | ±30 | V |
| $I_{C25}$ | $T_C$ = 25°C | 154 | A |
| $I_{C110}$ | $T_C$ = 110°C | 40 | A |
| $I_{CM}$ | $T_C$ = 25°C, 1ms | 370 | A |
| SSOA (RBSOA) | $V_{GE}$ = 15V, $T_{VJ}$ = 150°C, $R_G$ = 1Ω | $I_{CM}$ = 80 | A |
| | Clamped Inductive Load | 1500 | V |
| $P_C$ | $T_C$ = 25°C | 1500 | W |
| $T_J$ | | -55 ... +175 | °C |
| $T_{JM}$ | | 175 | °C |
| $T_{stg}$ | | -55 ... +175 | °C |
| $T_L$ | Maximum Lead Temperature for Soldering | 300 | °C |
| $T_{SOLD}$ | 1.6 mm (0.062in.) from Case for 10s | 260 | °C |
| $F_C$ | Mounting Force | 20..120/4.5..27 | N/lb |
| Weight | | 6 | g |

**TO-247PLUS-HV**




G = Gate E = Emitter
C = Collector Tab = Collector

## Features

- High Voltage Package
- High Blocking Voltage
- High Peak Current Capability
- Low Saturation Voltage

## Advantages

- Low Gate Drive Requirement
- High Power Density

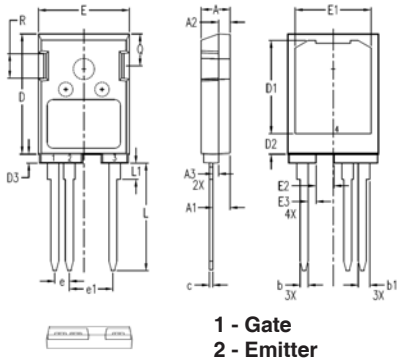
## Applications

- UPS
- Motor Drives
- SMPS
- PFC Circuits
- High Frequency Power Inverters

| Symbol | Test Conditions ($T_J$ = 25°C, Unless Otherwise Specified) | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|
| $BV_{CES}$ | $I_C$ = 250μA, $V_{GE}$ = 0V | 2500 | | | V |
| $V_{GE(th)}$ | $I_C$ = 250μA, $V_{CE}$ = $V_{GE}$ | 3.0 | | 5.0 | V |
| $I_{CES}$ | $V_{CE}$ = $V_{CES}$, $V_{GE}$ = 0V | | | 15 | μA |
| | $T_J$ = 150°C | | | 4 | mA |
| $I_{GES}$ | $V_{CE}$ = 0V, $V_{GE}$ = ±20V | | | ±100 | nA |
| $V_{CE(sat)}$ | $I_C$ = 40A, $V_{GE}$ = 15V, Note 1 | | 3.2 | 4.0 | V |
| | $T_J$ = 150°C | | 4.4 | | V |

| Symbol | Test Conditions ($T_J$ = 25°C Unless Otherwise Specified) | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|
| $g_{fs}$ | $I_C$ = 40A, $V_{CE}$ = 10V, Note 1 | 24 | 42 | | S |
| $R_{Gi}$ | Gate Input Resistance | | 2.0 | | Ω |
| $C_{ies}$ | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | | 5470 | | pF |
| $C_{oes}$ | | | 204 | | pF |
| $C_{res}$ | | | 74 | | pF |
| $Q_{g(on)}$ | $I_C$ = 40A, $V_{GE}$ = 15V, $V_{CE}$ = 0.5 • $V_{CES}$ | | 270 | | nC |
| $Q_{ge}$ | | | 28 | | nC |
| $Q_{gc}$ | | | 110 | | nC |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 25°C** | | 21 | | ns |
| $t_{ri}$ | $I_C$ = 40A, $V_{GE}$ = 15V | | 22 | | ns |
| $E_{on}$ | $V_{CE}$ = 0.5 • $V_{CES}$, $R_G$ = 1Ω | | 11.7 | | mJ |
| $t_{d(off)}$ | Note 2 | | 200 | | ns |
| $t_{fi}$ | | | 134 | | ns |
| $E_{off}$ | | | 6.9 | | mJ |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 150°C** | | 21 | | ns |
| $t_{ri}$ | $I_C$ = 40A, $V_{GE}$ = 15V | | 22 | | ns |
| $E_{on}$ | $V_{CE}$ = 0.5 • $V_{CES}$, $R_G$ = 1Ω | | 14.7 | | mJ |
| $t_{d(off)}$ | Note 2 | | 255 | | ns |
| $t_{fi}$ | | | 250 | | ns |
| $E_{off}$ | | | 11.5 | | mJ |
| $R_{thJC}$ | | | | 0.10 | °C/W |
| $R_{thCS}$ | | | 0.15 | | °C/W |

**TO-247PLUS-HV Outline**



**1 - Gate**
**2 - Emitter**
**3,4 - Collector**

| SYM | INCHES MIN | INCHES MAX | MILLIMETERS MIN | MILLIMETERS MAX |
|---|---|---|---|---|
| A | .193 | .201 | 4.90 | 5.10 |
| A1 | .114 | .122 | 2.90 | 3.10 |
| A2 | .075 | .083 | 1.90 | 2.10 |
| A3 | .035 | .043 | 0.90 | 1.10 |
| b | .053 | .059 | 1.35 | 1.50 |
| b1 | .075 | .083 | 1.90 | 2.10 |
| c | .022 | .030 | 0.55 | 0.75 |
| D | .819 | .843 | 20.80 | 21.40 |
| D1 | .638 | .646 | 16.20 | 16.40 |
| D2 | .134 | .146 | 3.40 | 3.70 |
| D3 | .055 | .063 | 1.40 | 1.60 |
| E | .622 | .638 | 15.80 | 16.20 |
| E1 | .520 | .528 | 13.20 | 13.40 |
| E2 | .118 | .126 | 3.00 | 3.20 |
| E3 | .051 | .059 | 1.30 | 1.50 |
| e | .100 BSC | | 2.54 BSC | |
| e1 | .300 BSC | | 7.62 BSC | |
| L | .732 | .748 | 18.60 | 19.00 |
| L1 | .106 | .118 | 2.70 | 3.00 |
| Q | .216 | .224 | 5.50 | 5.70 |
| R | .165 | .169 | 4.20 | 4.30 |

Notes:

1. Pulse test, t ≤ 300µs, duty cycle, d ≤ 2%.
2. Switching times & energy losses may increase for higher $V_{CE}$(Clamp), $T_J$ or $R_G$.

**ADVANCE TECHNICAL INFORMATION**

The product presented herein is under development. The Technical Specifications offered are derived from a subjective evaluation of the design, based upon prior knowledge and experience, and constitute a "considered reflection" of the anticipated result. IXYS reserves the right to change limits, test conditions, and dimensions without notice.

**Fig. 1. Output Characteristics @ $T_J$ = 25°C**

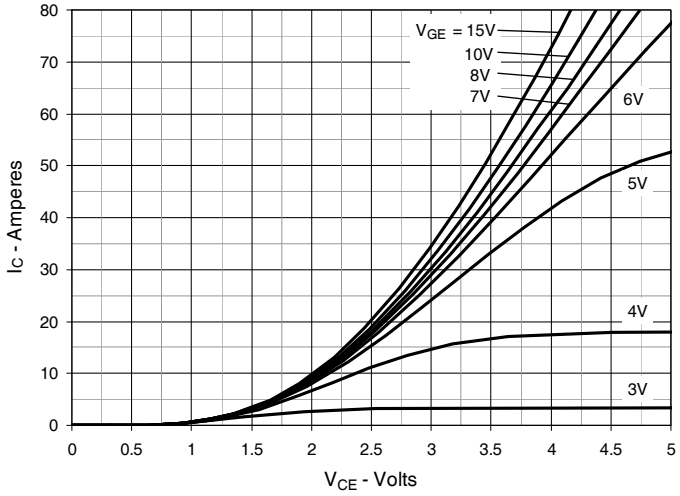



**Fig. 2. Extended Output Characteristics @ $T_J$ = 25°C**

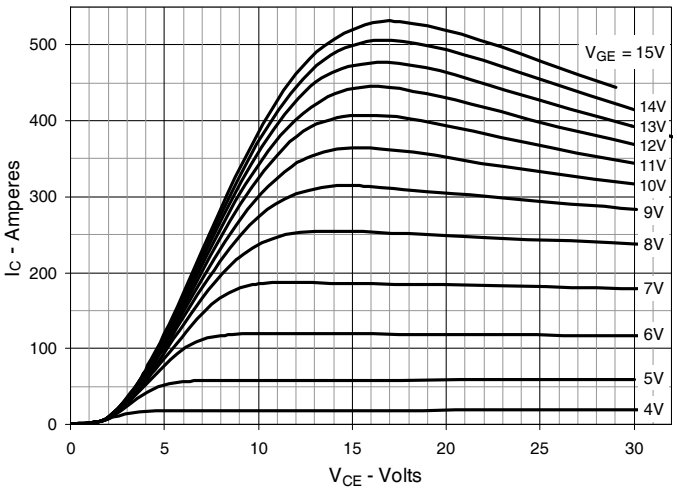



**Fig. 3. Output Characteristics @ $T_J$ = 150°C**

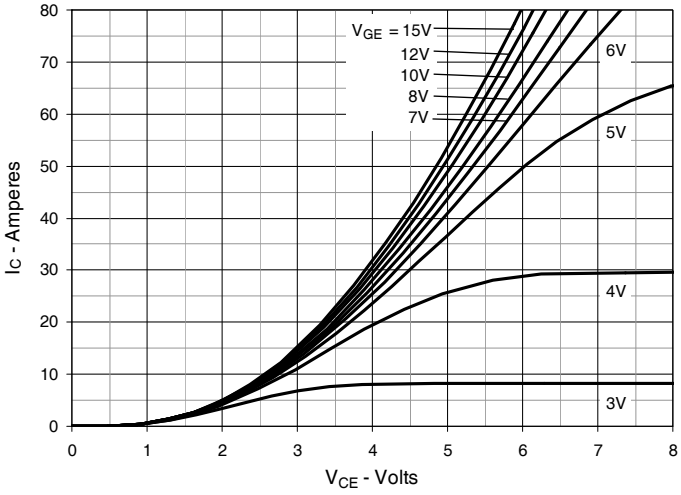



**Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature**

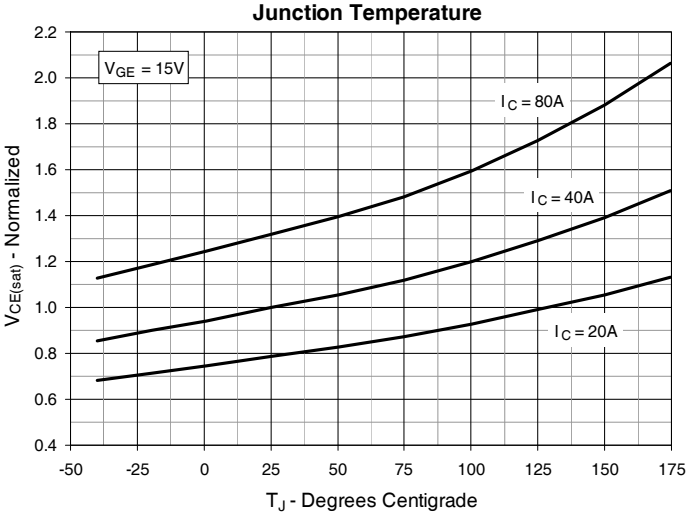



**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage**

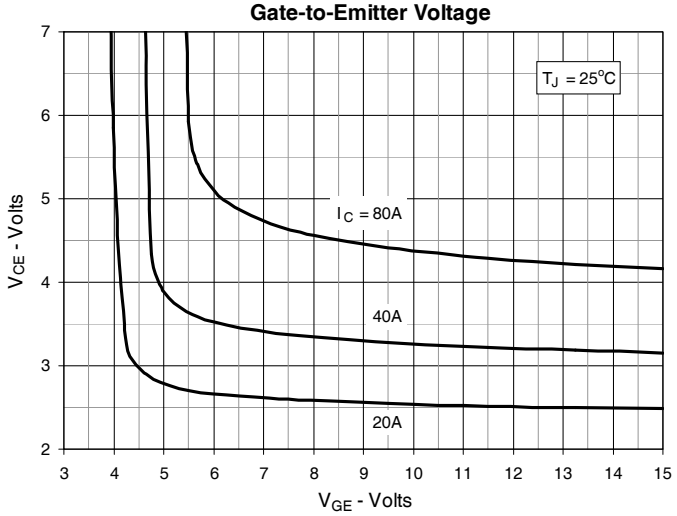



**Fig. 6. Input Admittance**

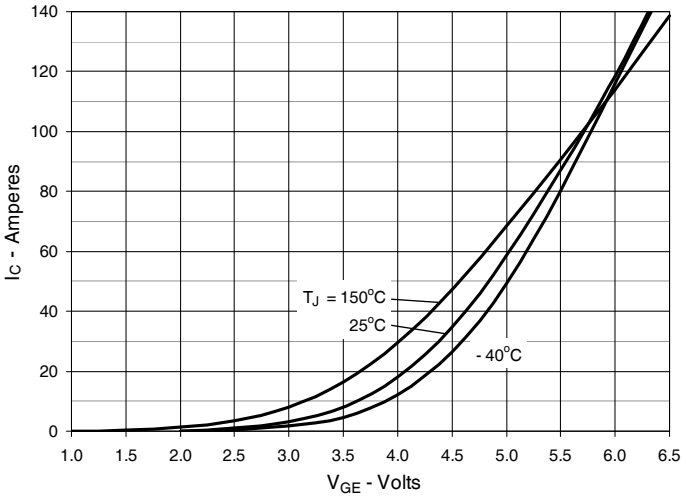


**Fig. 7. Transconductance**

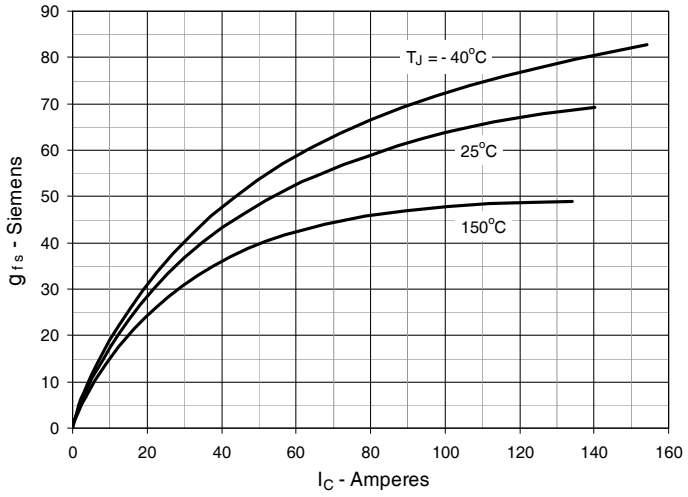



**Fig. 8. Gate Charge**

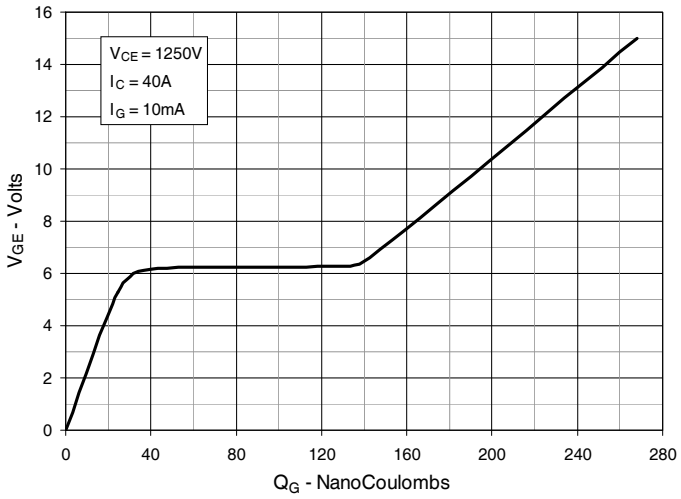



**Fig. 9. Capacitance**

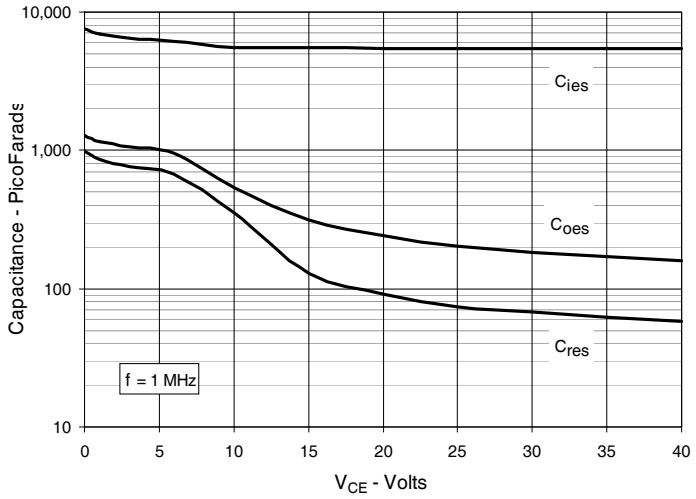



**Fig. 10. Reverse-Bias Safe Operating Area**

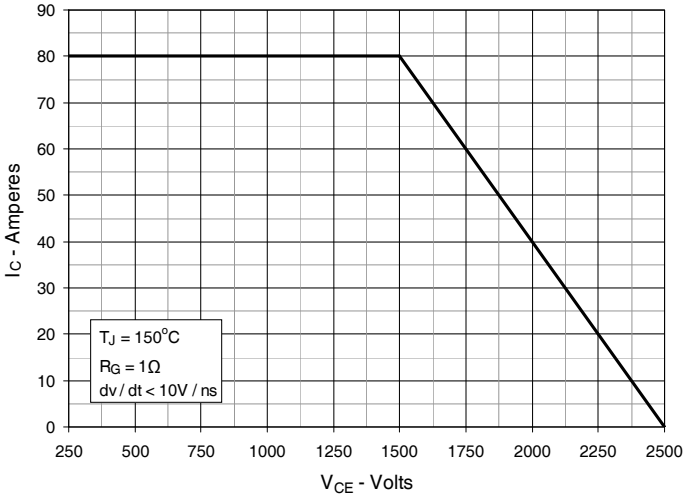



**Fig. 11. Maximum Transient Thermal Impedance**

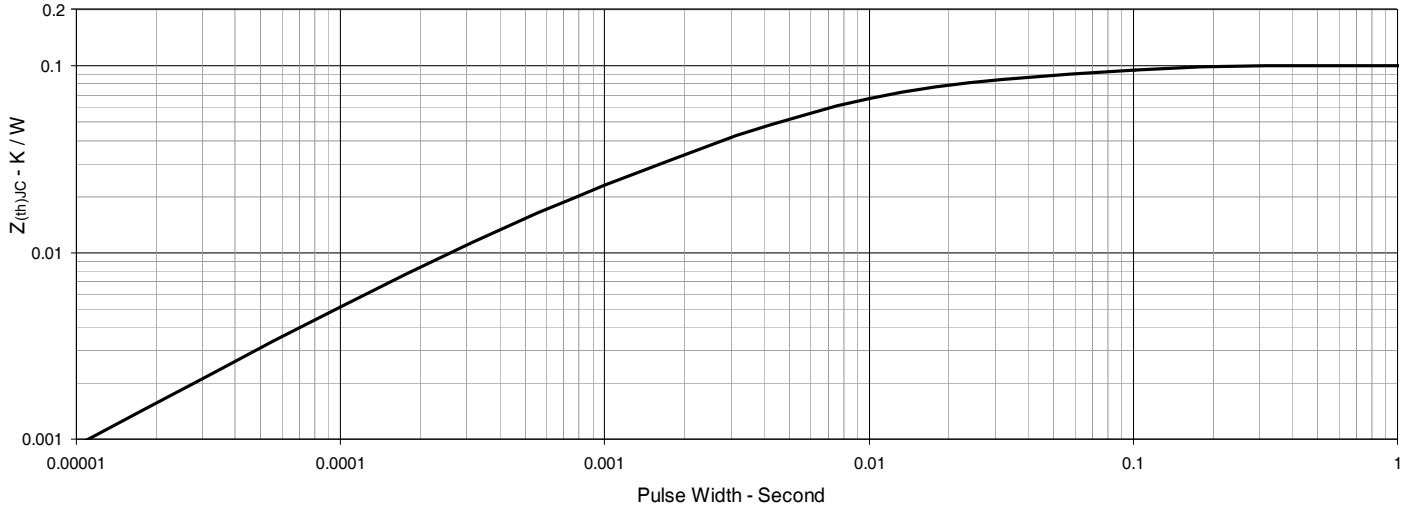


**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**

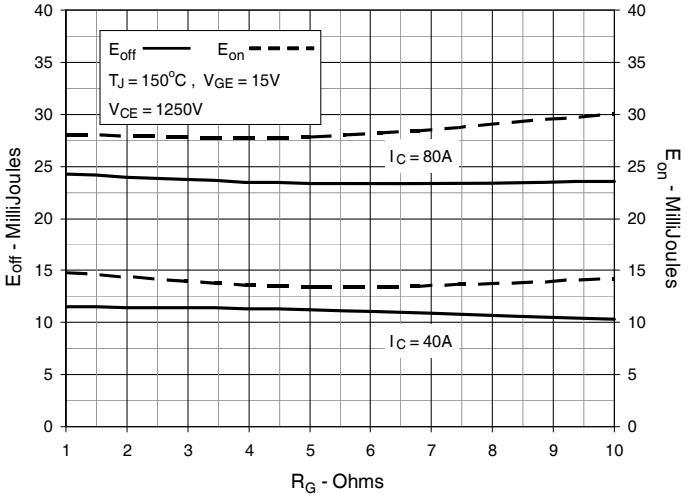



**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**

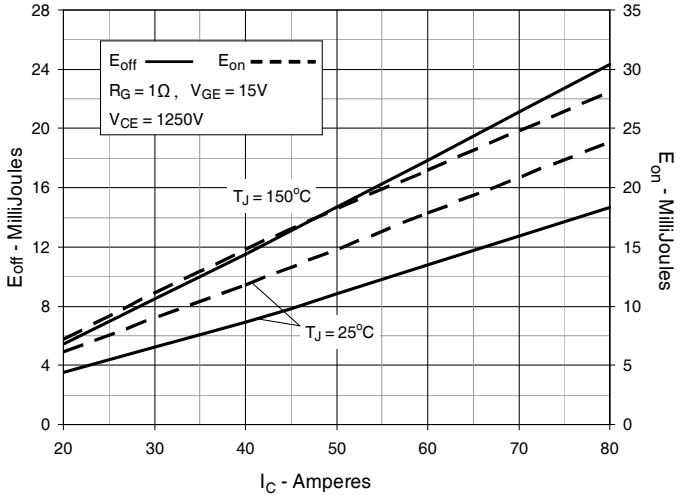



**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature**

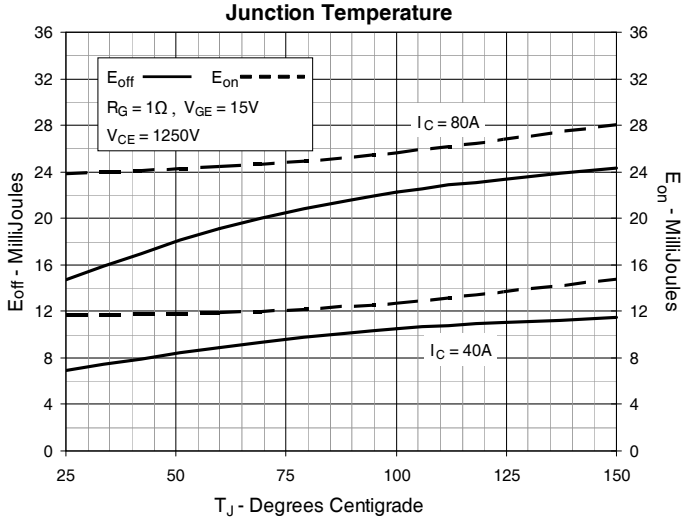



**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**

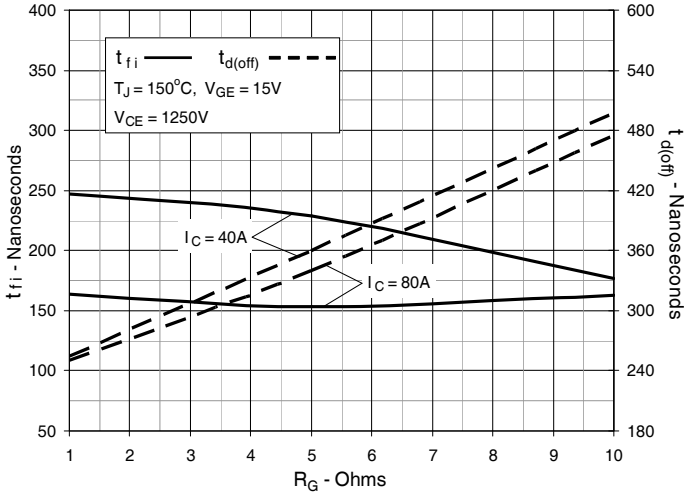



**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**

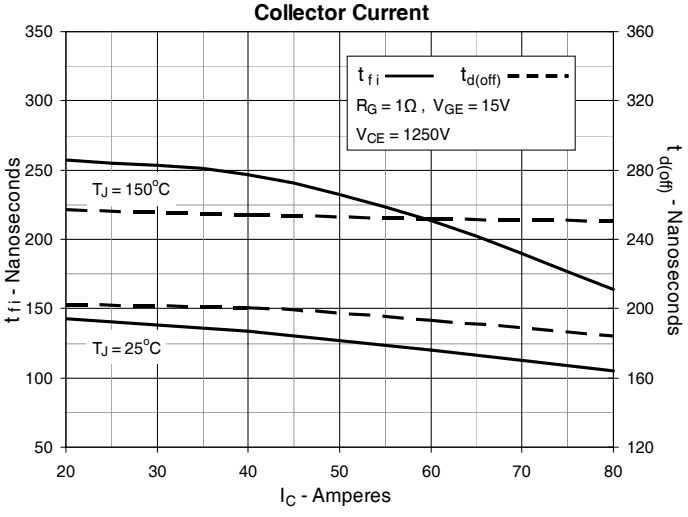



**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**

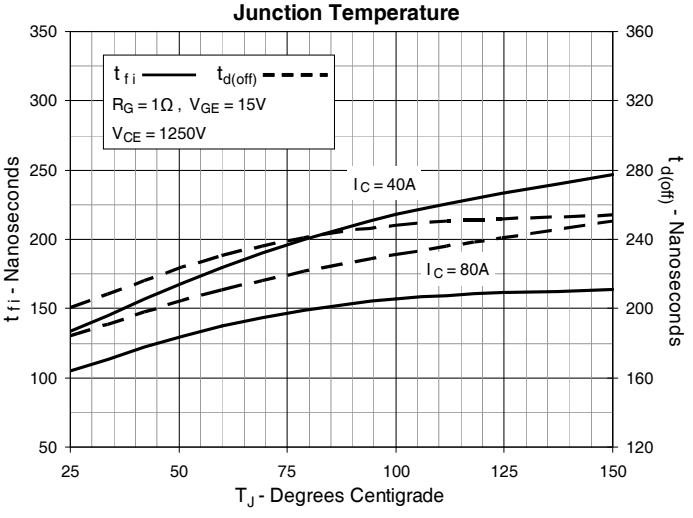


**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**

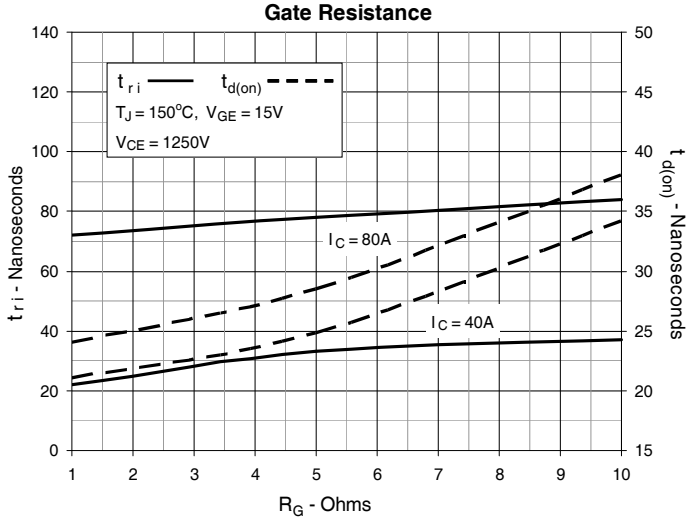



**Fig. 19. Inductive Turn-on Switching Times vs. Collector Current**

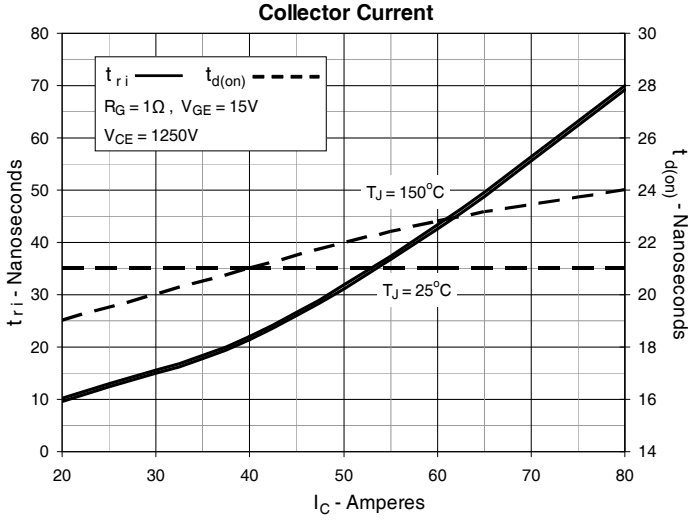



**Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature**